The challenge of the Biosciences in nurse education

The challenge of the Biosciences in Nurse Education: *A literature review*

Abstract

Aims and objectives. To review relevant literature that address the challenges of the biosciences in nurse education. More precisely the review aims to explore the literature, concerning students' learning, learning contexts and methodological issues and identify any significant gaps.

Background. Knowledge of anatomy, physiology and biochemistry are essential for the understanding of human beings and for full appreciation of the concepts of illness and disease. The current status would seem to be that the required competencies within bioscience subjects are difficult to acquire and students have high rates of failure.

Design. Integrative review.

Methods. The research were performed on Cinahl, ERIC, Medline and British Nursing Index databases in a period from 2013 until 2017. Descriptive analytical methods were used for the initial research trawl.

Findings. The search strategy resulted in 23 papers. The results of this review shed light on certain deficiencies in the research field looking at the biosciences in nurse education. There is a distinct lack of intervention studies, and thereby knowledge of how best to support students' learning in effective ways. Of note is that there are no field study approaches identified in the review sample.

Conclusion. Many of the papers are single studies and course evaluations which may be seen as too narrow and inadequate a perspective. Students appear satisfied with the courses in the biosciences but there seems to be no correlation between satisfaction and achievement.

Relevance to clinical practice: Understanding and being able to give coherent rationales for the bioscience content in the nursing curricula is crucial and must be established in relation to its relevance to the dynamic nature of patient care, technological advances and demographic realities. Only on that basis can the primacy of this content be seen as relevant to the aspiring student nurse.

Key words: Nurse Education, Nurse Students, Literature Review, Biological Subjects

Introduction

The foundations of nursing knowledge are composed of nursing sciences, bioscience, social sciences and humanities. The Biosciences are an area of knowledge acquisition that nursing students struggle to acquire in higher education and then apply to clinical practice (Bakon, Craft, Christensen & Wirihana, 2016). McVicar, Andrew and Kemble (2015) identified many problems with the teaching of bioscience to nursing students, such as ensuring the necessary learning environment, course organisation and the appropriate support for students learning the principles of human biosciences early in the curriculum. Nursing programmes face the challenge of high failure rates within the biosciences, and a recurring theme emerges that nurse education has not dedicated sufficient resources to these subjects (McVicar, Andrew & Kemble 2014; Bakon et al., 2016).

Additionally, biomedical models, often employed in nurse education, have been seen by nurses as reductionist and are criticised for not presenting a holistic view of individuals, and are thus considered insufficient, even irrelevant, in preparing student nurses for the practice of psychosocial and person-centred care (Beedholm & Frederiksen, 2015). However, to understand fully the patients' needs and experiences, both of the mind and the body, requires knowledge about patients' disease and its subjective experience illness (Eisenberg, 1977).

Smeby and Heggen (2015) demonstrates how the knowledge base in professions is fragmented and heterogeneous, based on knowledge from different academic fields and disciplines. Nursing is built on different bodies of knowledge, ideally meaningfully brought to harmonise with, and create optimal nursing practice.

Throughout the history of nursing as a taught discipline, tensions have existed between the arts, social sciences and humanities and the biological and medical sciences. Epistemological studies of nursing science have demonstrated how nursing 'science' developed, at least partially, in opposition to the medical science ideals. By contrast considerable emphasis in nursing science has been placed on more phenomenological approaches, where, for example, a patient's reactions to health problems have been at the fore (Munhall, 2012). In the 1980s, the rise of nursing as a science led to a perceived, if not actual, distancing from medical science. In Denmark, Beedholm and Frederiksen (2015) describe the nursing science as a mechanism of anti-medicine, which included the disappearance of 'the body' in nursing discourse in the 1970s and 1980s. The focus, it is argued, has changed from the soma to the psyche in terms of the patients' experiences and reaction of illness. Fawcett,

Waugh and Smith (2016) describe the life sciences as a forgotten priority in nursing education in the UK; a gradual erosion of its presence following a change in direction within nursing education from a focus on illness to a focus on health, embodied in *Project 2000; a new preparation for practice*.

In nurse education, the biosciences are often taught as separate disciplines, often by a scientist (Craft et al, 2013; McVicar et al, 2015). This can create pedagogic challenges regarding the relevance to nurses' professional practice. Such challenges play into an on-going debate in nurse education about whether content should be structured in accordance with the different disciplines or be framed through patient and client based problems, where various subjects can be appropriately integrated. Relevance and 'scientification' have been a particularly important discussion in the field of higher education in Norway (Smeby & Sutphen, 2015).

The current status would seem to be, therefore, that the required competencies within bioscience subjects are difficult to acquire and students have high rates of failure. In the NOKUT report from 2016 the researchers found that the level of knowledge in these subjects is comparatively low, with an average failure rate of 22% (Fjelde & Ruud, 2016). The field of biosciences is necessarily of great importance for the practice and understanding of nursing, especially in clinical decision-making. Knowledge of anatomy, physiology and biochemistry are essential to understand human beings and for full appreciation of the concepts of illness and disease. Equally Sulosaari, Suhonen, Leino-Kilpi (2011) point to knowledge of anatomy and physiology as a primary foundation for understanding the principles of pharmacology. Additionally, such competency assessments pave the way for meta-questions about profession and knowledge, such as how nursing disciplines can optimize their professionalism, and what forms of knowledge are significant in this context, not least the shifting alliances between scientific, social science and the humanities. Education in the biosciences presents multifactorial challenges related, at least in part, to entrance achievements, differences in motivation and concentration levels, large classes, the number of teaching hours and course duration.

Aims

Theoretical and empirical work has illuminated the differences between nursing science and the biosciences. In addition, research has raised a discussion about the 'academisation' and its relevance for the nursing profession. Furthermore there is only limited research as to what kind of educational inventions contribute to students' results. The aim of this study is to

review relevant literature that address and look to suggest an explication as to why many nursing students' find bioscience in nurse education challenging. More precisely the review looks to understand students' learning, learning contexts and methodological issues and identify any significant gaps in the literature.

Methods

This study is part of a project which is a cooperation between Norway, Denmark and the United Kingdom (UK). The aim of the project is to examine the problem of integrating the biosciences in nurse education. Our intention in this study was to carry out an integrative review (Whittemore & Knafl, 2005). According to Whittemore and Knafl (2005) an integrative review consist of five stages; problem identification stage, literature search stage, data evaluation stage, data analysis stage and the presentation.

An electronic search was conducted to identify relevant studies from different databases. The electronic databases employed were Cinahl, ERIC, Medline and British Nursing Index in a period from 2013 until 2017. The following key words were used: 'students, nursing', 'education, nursing, baccalaureate', 'biological science disciplines' or 'anatomy' or 'biochemistry' or 'biology' or 'biomedicine' or 'biophysics' or 'physiology'. The studies included in the review were: (1) empirical studies in peer review journals, (2) studies concerning nursing students, their experience and their outcomes in bioscience, (3) studies describing the learning context in bioscience in nurse education.

Studies concerned with other student health care professionals and studies on specific pathophysiology were excluded (such as cancer genetics or medical treatment). The search strategy, identified in Figure 1 below, resulted in 23 papers.

Descriptive analytical methods involving a common analytical framework were used for the initial research trawl. Firstly, general information was collected: author, year, journal, research objectives/aims, methods and findings. Secondly, the papers' characteristics related to the aim of the study which is to understand students learning and the learning context in bioscience. This review examined the research on students' experience, their learning outcome, learning context and the studies' limitations. In order to explore the learning context, we have addressed situations that students will meet in the course of their educational programme: lectures, seminars, group work and independent study. Thirdly, the aim of the study is to identify and analyse the notable gaps in the literature.

The final sample for this review was entirely empirical papers with a variety of methods, such as cross-sectional studies, mixed methods, quasi-experimental study, focus groups or interview, and document analysis. Some studies are deeply qualitative and therefore have limited number of participations. An obvious limitation were the studies based on authors' own course evaluations.

Findings

Methodological issues:

Twenty three papers are single studies. Six papers have small samples, less than 30 participants (Craft, Christensen, Bakon & Wirihana, 2017; Craft et al., 2016; dos Santos, da Silva, Estrela & Barauna, 2016; Mayner, Gillham, & Sansoni, 2013; Molesworth & Lewitt, 2015; Taylor, Ashelford, Fell & Goacher, 2015). These studies have used both questionnaires and qualitative approaches using interviews and focus groups. The qualitative approaches enable in depth examination and exploration of the learning contexts and students learning outcomes. The remaining papers have from 65 to 1320 respondents, mostly nursing students, some faculty members, bioscience lecturers in nurse education and registered nurses. One study (Logan & Angle, 2014) has an institutional approach. Most of the papers are about courses and course evaluation which may be seen as a particularly narrow perspective (table 1).

The papers have used questionnaire/survey (10), interviews/focus groups (2), intervention studies (2), cohort study (1), evaluation study (1), document analysis (1) and mixed methods (6).

Students' learning:

Students with high self-efficacy as measured by different instruments, such as Self-Efficacy for Science (SEFS), Task Value (TV) and Self-Efficacy for Academic Performance (SEAP), valued science more and had higher expectations for success. Equally, students with a higher sense of coherence were more self-regulated in their learning approach and they achieved higher academic grades. Making the biosciences relevant to practice strengthened the learning. However, some of the papers' authors assert that problems of learning in clinical practice were, at least in part, due to the clinical nurses' lack of competence and supervisors'

lack of explaining the biological bases for nursing. Students are usually satisfied with their bioscience courses and see the courses as important for nursing but this sense of satisfaction does not appear to correlate with the students' grades. Students see the courses as challenging, difficult and anxiety provoking, but they value various pedagogic styles identifying technologies, such as flipped classroom, podcast, e-atlas, or simulation as useful for their learning. The reviewed articles do not address student self-directed learning activities, the time and effort they spend on preparing for the lectures and for the examinations, or why students find bioscience in nurse education challenging.

Learning context:

Sixteen of twenty-three papers looked at first year courses in bioscience. Some of these authors looked at courses both in first, – and second year (1) and first – and third year (2). Courses in final year was addressed in three papers. The authors of two papers described the learning context retrospectively.

The situations that were identified to impact on learning varied from simulation to interactive electronic learning devices, from team-teaching to learning in clinical placement, from laboratory learning to analysing episodes of "House M.D", from lectures to group-work and tutorials. Most of the studies are within the university context, with very few identified in the clinical setting. The idea of making bioscience relevant to clinical settings is highly recommended in most of the reviewed papers. It should be noted that the clinical settings were not explored as a learning context and it is argued that evidence is lacking as to the impact of bioscience within, and from, the clinical settings of practice. Many of the reviewed studies were located in a single site (15). The majority of the articles were from Australia (13) and UK (7).

Discussion

The results of this review shed light on certain deficiencies in the research field looking at the biosciences in nurse education. There is a distinct lack of intervention studies, and thereby knowledge of how best to support students' learning in effective ways. Of note is that there are no field study approaches in our review sample. Despite this, inquiries as to what happens in the classroom can reveal interesting data about students' activities, their preparedness and concentration, alongside relational aspects in various learning situations. Another identified

lack is that of a broader and critical perspective on the biosciences. Interestingly, the problem of nursing science as an anti-medical science is not clarified, or even explored, in the examined studies. Equally, the literature appears to lack any discussion about the status of biosciences in nursing. The authors argue that the research field addressing bioscience in nursing could benefit from a broader range of inquiry to provide a better understanding of, what Fawcett et al. (2016) described as a forgotten priority in nursing. In this study, we have focused on students' initiatives and perspectives, professional content, the context and facilitation of learning.

Student initiative and perspectives

As has been indicated, student satisfaction with the courses are consistently high. Even though students seem to score highly on satisfaction in the courses, the examination results are not commensurate with their satisfaction and are relatively poor. The lecturers have high expectations, but the students' attainment is low. High achieving students seem to have high self-efficacy and are self-regulated in their learning approach. Salamonson, Ramjan, van den Nieuwenhuizen, Metcalfe, Chang, & Everett, (2016) refer to Zimmerman and Schunk (2001 p.209) in defining self-regulated learning as "*how learners control their thoughts, and behaviours in order to achieve academically*". If a student's individual characteristics are important for understanding how they perform, nursing education needs to discuss and consider how to both know about and increase these kinds of individual factors.

Teachers need to believe in students' capability and thereby both recognise and allow them to have control over their approaches to optimal learning. There has to be a predictable coherence between learning situation and examination. This review reveals a lack of knowledge about the time and effort spent on self-directed study and supplementary work, despite it being assumed. To understand how instructional practices within bioscience support and contribute to student learning, it is argued that research is required to explore the relationship between instructional styles and learning approaches and subsequent student achievement. Of note there is a distinct lack of explanation or even suggestions as to why many nursing students find learning biosciences so challenging. Craft et al (2013) demonstrated that registered nurses lack confidence in explaining the biological basis for their nursing practice and decision making. Equally in this literature review there is a lack of data on how both practising nurses and nurse educators value the biosciences.

The quality of education is often measured by student satisfaction surveys, which we also see in this review. However satisfaction scores can be questioned as a reliable indicator of quality, due to an uncertain correlation between satisfaction and students results on examinations and other forms of assessment. More to the purpose, it is argued that well prepared students obtain better grades.

Professional content

Of ongoing importance in nurse education is how to structure the content of curriculum, and both distinguish and integrate the different relevant disciplines. Key to such decisions is that the content must be relevant to the care needs and priorities for current professional practice. An ongoing concern is the timing and timetabling of learning different aspects of professional competence. Most of the bioscience courses, in this study, are delivered in the first year and are almost thought of as a separate discipline. In addition, the bioscience examinations in such countries as Norway are nationally rather than locally determined which in itself serves to somewhat segregate the biosciences form the rest of the nursing curricula. According to Smeby and Heggen (2015) the professional knowledge is heterogeneous and characterized as practical synthesis. This issue must be that of making the biosciences intimately relevant to nursing practice and that at present this is, arguably, not the case reinforcing the long standing concern of the theory-practice gap. It would seem that the integration of theory and practice is left to the learners to effect when in the practice setting. Indeed, the review reveals a lack of knowledge about the use and the impact of bioscience in nursing practice. It is argued here that the academic staff need to make closer links with practice such that learners can immediately identify the relevance of bioscience content and the practicum/practice placement reality.

Context and facilitation of learning

Many studies explore new ways of teaching and instruction, for example the use of digitally aided equipment and looks to evaluate new methods and the increasing use of games, such as electronic role-play, kahoot, simulation and other game elements. The aim is to emphasise enjoyment and engagement, thereby facilitating their continued learning. The findings of this review shows that student engagement and satisfaction are increased by the use of such tools and interventions, but the achievement levels in biosciences are not concomitantly improved. Further studies are needed to enlighten the relationship between games and learning in a

nursing context. Still the research on interventions as McVicar et al. (2014) pointed out, are on the benefit for students rather than objective measures of impact on actual learning.

Conclusion

This paper has looked to understand the challenges student nurses appear to have with the biosciences and has identified significant gaps in this field of research with only a few published studies on this topic. Many of the papers are single course evaluations which may be seen as too narrow a perspective. Students appear satisfied with the courses in the biosciences but there seems to be no correlation between satisfaction and achievements. However, the students seem to achieve a higher academic level when they are well prepared and can see the relevance of the biosciences for nursing. Well-prepared in this context, include both level of achievement at entry against the required criteria for bioscience and personal commitment of those students to work hard both in preparing for, and engaging with, the bioscience lecture content

To address the gaps in the research literature revealed in this paper the recommendation could be to design studies that address the broader issues, whereby the professional knowledge base in relation to bioscience content, content that is fully responsive to societal need, is properly determined. Equally, the nature of the learning environment, the use of technologies and students' study skills merits greater attention, ideally in the form of naturalistic studies.

Relevance to clinical practice

Understanding and being able to give coherent rationales for the bioscience content in the nursing curricula is crucial and must be established in relation to its relevance to the dynamic nature of patient care, technological advances and demographic realities. Only on that basis can the primacy of this content be seen a relevant to the aspiring student nurse.

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